COMPUTER BASED SPEED CONTROLLER FOR DC MOTOR USING XS95 CPLD (XILINX)

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ABSTRACT

This paper consists of developing a speed controller system for DC motors. The 3-phase half wave rectifier using Complex Programmable Logic Device or CPLD (XS95) using Xilinx software will be use to design the controller. To vary the speed of the DC Motor, the firing angle (α) of the thyristors should be varying by using external data controller (using 8-bit DIP switch). Thus, CPLD is use to control the thyristors, where it switch sequentially during positive cycle of the input voltage. This will vary the firing angles (α) such to control the output of 3-phase half wave rectifier. The DC voltage produced at the output can be maximum voltage (for high speed) or low voltage (for minimum speed) for the DC Motor.

In order to make the controlling of the output of certain system via a rectifier easier, it is possible to control the input signal through it. Since the input signals are fed from the three-phase power supply, there are several interface circuit must be connected to merge the operational of rectifier. The digital software then, controls all the interface circuit where it is download into an external board for implementation called CPLD.

When the complete circuit is operating, the input signal setting can be control by varying the firing angle α. Once it controlled, it will produced the output as expected. The observation can be made through the waveform shape where it is represented by mean voltage.

As a result, it shows that by using the CPLD, the output of rectifier is now having the controllable output where it is suitable to connect with any load such as DC Motor to control its speed.

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CHAPTER I

BACKGROUND OF THESIS

1.1 Introduction

There are numerous applications where control of speed is required, as in rolling mills, cranes, hoists, elevators, machines tools, and transit system and locomotive drives. DC motors are extensively used in many of this application. Control of the speed of DC motors below and above the base (or rated) speed can easily be archived. Besides, the methods of control are simpler and less expensive than those applicable to AC motor. Recently, solid-state converters have been used for this purpose. [6 & 7]

Standard shunt motors are classified as either constant speed or adjustable speed motors. Adjustable speed motors may be operated over a wide speed range by controlling armature voltage and/or field excitation. The speed below the base speed can be controlled by armature voltage control method and field control method is used for speeds above the base speed. For the last thirty years, the development of various solid state switching devices in the Thyristor / Transistor families along with varieties of analog/digital chips used in control/firing circuits, has made an impact in the area of DC drives. These power electronic (solid state) controllers are of two types:

1. Thyristor Bridge Rectifiers (Converters) - supplied from ac supply.
2. Chopper Drives fed from DC supply.

A rectifier circuit is one which links an AC supply to a DC load, that is, it converts an alternating voltage supply to a direct voltage. The direct voltage so obtained is not normally level, as from a battery, but contains an alternating ripple component superimposed on the mean (DC) level. This project use half wave controlled rectifier to control the speed of DC motor, where the switching device used is thyristors.